

Application Serial No. 09/869,789
Amendment dated February 16, 2004
Reply to Office Action dated October 22, 2003

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-27 (canceled)

Claim 28 (new): A raster probe microscope for the examination of sample surfaces, comprising:

- a raster probe;
- a holding device for a sample with the sample surface to be examined;
- an arrangement for moving the raster probe and/or the sample by which the probe and sample can be brought into contact so that they interact with one another in a given manner;
- an arrangement for detecting the relative movement of the probe and sample;
- an arrangement for controlling the movement of the raster probe and/or sample and for exciting a vertical first raster probe and/or sample oscillation and for exciting at least one of a vertical and horizontal second raster probe and/or sample oscillation; and
- an arrangement for detecting at least one of a vertical and lateral deformation of the raster probe in at least one of: a vertical first oscillation and at least one of a vertical and horizontal second oscillation;
- the arrangement for detecting deformation recording two measuring signals characterizing the deformation of the raster probe in at least one of a vertical first oscillation and at least one of a vertical and horizontal second oscillation of the raster probe and/or sample.

Claim 29 (new): Raster probe microscope according to claim 1, wherein the arrangement for moving the raster probe and/or the sample comprises at least one first piezo element.

Claim 30 (new): Raster probe microscope according to claim 28, characterized by periodic raster-probe and/or sample oscillations.

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Claim 31 (new): Raster probe microscope according to claim 30, wherein the oscillation direction runs one of parallel and perpendicular to one of the sensing and scanning direction.

Claim 32 (new): Raster probe microscope according to claim 30, wherein the vertical oscillation of the raster probe and/or of the sample occurs with a first frequency of at least 10 Hz and a first amplitude of at least 1 nm.

Claim 33 (new): Raster probe microscope according to claim 32, wherein the frequency is 500 Hz to 1 kHz and the amplitude is 10 to 500 nm.

Claim 34 (new): Raster probe microscope according to claim 30, wherein the vertical oscillation of the raster probe and/or of the sample is additionally excited or modulated with a second frequency of at least 1 kHz and a second amplitude of at least 0.1 nm.

Claim 35 (new): Raster probe microscope according to claim 34, wherein the frequency ranges from 5 kHz to 1 MHz and the amplitude from 1 to 10 nm.

Claim 36 (new): Raster probe microscope according to claim 30, wherein the second raster-probe and/or sample oscillation is a horizontal oscillation with a frequency of at least 500 Hz and an amplitude of at least 0.1 nm.

Claim 37 (new): Raster probe microscope according to claim 34, wherein the frequency ranges from 10 to 100 kHz and the amplitude from 1 to 30 nm.

Claim 38 (new): Raster probe microscope according to claim 30 including an evaluating arrangement for the two measuring signals for the simultaneous determination of at least two material properties from the group consisting of the adhesion, the static and dynamic friction, the surface topography and the elasticity and rigidity.

Claim 39 (new): Raster probe microscope according to claim 38, wherein the evaluating arrangement comprises one of a lock-in amplifier and a microcomputer.

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Claim 40 (new): Raster probe microscope according to claim 28, wherein the raster probe is a point or tip of one of a force microscope and an optical near-field microscope.

Claim 41 (new): A process for the simultaneous determination of at least two material properties from the group consisting of the adhesion, the static and dynamic friction, the surface topography and the elasticity and rigidity of the surface of a sample to be examined, by means of a raster probe microscope comprising a raster probe, said process comprising the following process steps:

- a) moving the raster probe and/or the sample with the sample surface to be examined until the raster probe, at a pre-determined point of the sample surface to be examined, interacts in a determined manner with the sample surface, wherein the raster probe and/or the sample is subjected to a vertical first oscillation;
- b) recording a first measuring signal characterizing the deformation of the raster probe;
- c) recording a second measuring signal characterizing the deformation of the raster probe, in which the raster probe and/or the sample is subjected to at least one of a horizontal and vertical second oscillation;
- d) determining the desired material properties from the two measuring signals; and
- e) scanning the region of the sample surface to be examined by a return to the process step a) above.

Claim 42 (new): The process according to claim 41, wherein the raster probe and/or the sample is subjected to at least one periodic oscillation.

Claim 43 (new): The process according to claim 42, wherein the oscillation direction is chosen one of perpendicular to and parallel to one of a sensing and scanning direction.

Claim 44 (new): The process according to claim 41, wherein the vertical oscillation or the vertical oscillations has/have a frequency of at least 10 Hz and an amplitude of at least 1 nm.

Claim 45 (new): The process according to claim 44, wherein the frequency ranges from 500 Hz to 2 kHz and the amplitude from 10 to 500 nm.

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Claim 46 (new): The process according to claim 44, wherein on the vertical oscillation or oscillations there is superimposed at least one second oscillation with a frequency of at least 1 kHz and an amplitude of at least 0.1 nm.

Claim 47 (new): The process according to claim 46, wherein the frequency ranges from 5 kHz to 1 Mhz and the amplitude from 1 to 10 nm.

Claim 48 (new): The process according to claim 41, wherein the horizontal oscillation has a frequency of at least 500 Hz and an amplitude of at least 0.1 nm.

Claim 49 (new): The process according to claim 48, wherein the frequency ranges from 10 to 100 kHz and the amplitude from 1 to 30 nm.

Claim 50 (new): The process according to one of claims 41, wherein the raster probe is brought into contact with the sample surface with a determined normal or perpendicular force.

Claim 51 (new): The process according to claim 41, wherein for the evaluation of the measuring signals there is used one of a lock-in amplifier and a microcomputer.

Claim 52 (new): The process according to claim 41, wherein as the raster probe there is used the point or tip of one of a force microscope and an optical near-field microscope.

Claim 53 (new): The process according to claim 52, wherein the point or tip of the force microscope and the point or tip of the optical near-field microscope are integrated in a common raster probe.

Claim 54 (new): The process according to claim 41, wherein the raster probe and/or the sample are subjected simultaneously at least to a vertical and at least to a horizontal oscillation.